KNAUER

AZURA

Detector DAD 6.1L, DAD 2.1L, MWD 2.1L User Manual

V6700

HPLC

Table of Contents

Note For your own safety, **read** the manual and **always** observe the warnings and safety information on the device and in the manual!

Intended Use 6
Device Overview 6
Front View 6
Rear View 6
Side View 7
Features 7
Eluents 9

Scope of Delivery 10

Safety for Users 11
Definition of Personal and Material Damage 12
Decontamination 13

Symbols and Signs 13

Installation 14
Contact Data 14
Transport 14
Operating Environment 15
Space Requirements 15
Installation Site 15
Space Requirements 16
Setup 16
Unpacking 16
Inserting the Flow Cell 17
Inserting the Flow Cell with Fiber Optics 17
Connecting the Capillaries 18
Using the PEEK Fittings 19
Connecting the Leak Management 19
Control 20
Connecting the Device to the Computer 21
Configuring the LAN Settings 21
Connecting the Cables 22
Configuring the Router 23
Integrating the LAN into a Company Network 23
Controlling Several Systems Separately in a LAN 23
Using Remote Control 24
Connections to the Terminal Strip 25
Connecting Cables to the Terminal Strip 26
Integrator Connector 27

Power Connection 27
Integrating the Detector into the System 28
Pre-Installed Capillaries 29

Operation 29
Initial Start Up 29
Switch On 29
Operation 30
Operating with Chromatography Software 30
Operating with Control Unit 30
Operating with Mobile Control 30
Meaning of the LEDs 31
Resetting the Device 32

Optimizing the Detector 32
Location 32
Warm Up Time 33
Selecting the Flow Cell 33
Flow Cell Volume 33
Path Length 34
Wetted Parts 35
Pressure Stability 35
Connection 35
Remote Operation (Fiber Optics) 35
Selecting the Wavelength 35
Bandwidth 36
Spectral Range 36
Time Constant & Data Rate 37
Integration Time 38
Subtraction of the Baseline Chromatogram 38
General 39

Functionality Tests 39

Troubleshooting 40
LAN 40
Possible Problems and Rectifications 41
System Messages 41

Maintenance and Care. 45
Contacting the Technical Support 46
Maintenance Contract 46
Maintenance Intervals 46
Cleaning and Caring for the Device 46
Checking the Fittings 47
Decommissioning 47
Storage 47
Disconnecting the Power Supply 47

Cleaning the Flow Cell 48
Rinsing the Flow Cell 48
Replacing the Flow Cell 48
Replacing the Lamps 49
Removing the Deuterium or Halogen Lamp 49
Installing the Deuterium or Halogen Lamp 50
Removing the Leak 52

Technical Data 52
DAD 6.1L 52
DAD 2.1L 53
MWD 2.1L 55
Conditions for Specification 56

Disposal 56

Legal Information 57
Warranty Conditions 57
Transport Damage 57

HPLC Glossary 57

Accessories and Spare Parts. 59
Device 60
Accessories and Spare Parts 60
Flow Cells 61
Flow Cells with Fiber Optics 61
Fiber Optic Cables 62

Index 63

Declaration of Conformity. 66

An alle, die es betrifft

Wenn Sie ein französischsprachiges Benutzerhandbuch zu diesem Produkt wünschen, senden Sie ihr Anliegen und die entsprechende Seriennummer per E-Mail oder Fax an KNAUER:

- support@knauer.net
- +49 30 8015010

Vielen Dank.

To whom it may concern

In case you prefer a French language user manual for this product, submit your request including the corresponding serial number via email or fax to KNAUER:

- support@knauer.net
- +49 30 8015010

Thank you.

A qui que ce soit

Si jamais vous préfériez un manuel en francais pour ce poduit contacter KNAUER par email ou par fax avec le no. de série:

- support@knauer.net
- +49 30 8015010

Merci beaucoup.

Intended Use

Note Only use the device for applications that fall within the range of the intended use. Otherwise, the protective and safety equipment of the device could fail.

Description The detector can be used for analytical, semi-preparative and preparative applications.

Operating Ranges The device can be used in the following areas:

- biochemical analysis
- chemical analysis
- food analysis
- pharmaceutical analysis
- environmental analysis

Device Overview

Front View

On the front of the device, there are the flow cell and the removable lamp cover for lamp replacement.

Legend

① leak tray
② capillary guide
③ lamp cover
④ serial number
⑤ leak management
⑥ switch/standby key
⑦ status LED
⑧ flow cell

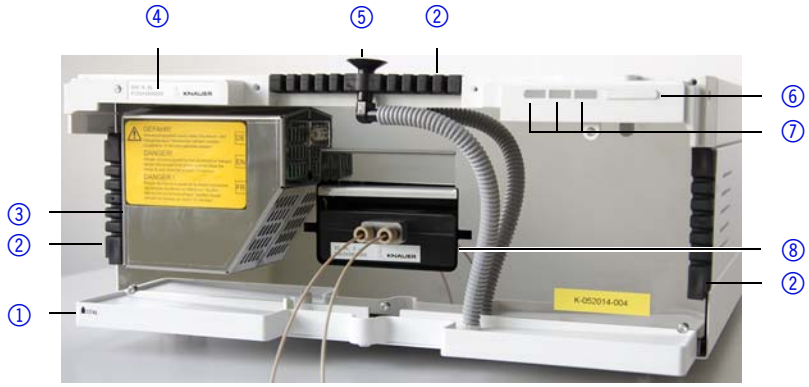


Fig. 1 front view (example DAD 6.1L)

Rear View

On the back of the detector, the connectors for LAN and power plug are located, as well as the serial number of the device and the power switch (on/off).

RS-232, Service Interface Please note that the service interface is solely used for repair and maintenance tasks performed by service technicians.

Legend

① device information

② integrator outlets

③ LAN connector

④ service interface

⑤ multi-pin connector

⑥ fan

⑦ connection and power switch

Fig. 2 rear view (example DAD 6.1L)

Side View

On the side of the detector, you find the connector for the operating panel Control Unit (see 'Operating with Control Unit' on page 30).

Legend

① USB port for the Control Unit

Fig. 3 USB port for the Control Unit

Features

In an HPLC system, the detector serves to detect substances in liquids and show their concentration. The sensitivity of the detector depends on the installed flow cell.

Optical Module

The detectors measure the light absorption of the sample in the ultraviolet and visual spectra. The entire spectrum permeates the sample and afterwards is split up by a grate. The split light falls onto a geometric array of 1024 (DAD 6.1L) or 256 (DAD 2.1L, MWD 2.1L) separate photodiodes – the photodiode array.

The optical system of the AZURA DAD 6.1L is depicted in figure 4. An active temperature control with 0.5 °C sensitivity ensures baseline stability for minimal baseline drift.

Legend

① deuterium lamp

② halogen lamp

③ flow cell

④ diode array sensor

⑤ diffraction grating

⑥ mirror

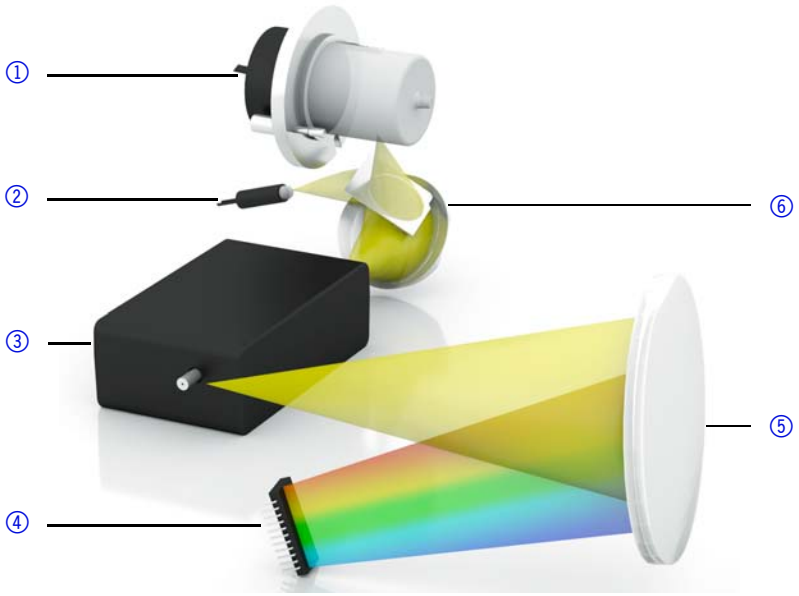


Fig. 4 optical system DAD 6.1L

Lamps The lamps can be exchanged quickly and easily without the need of a service technician.

DAD 6.1L 2 light sources, a deuterium lamp and a halogen lamp, cover the entire UV-Vis wavelength range.

DAD 2.1L, MWD 2.1L 1 deuterium lamp covers the UV wavelength range.

Mirror DAD 6.1L Maximum light intensity is provided by effectively mixing the light sources from the deuterium and halogen lamp with a mirror using Polka Dot technology.

Flow Cell Various types of flow cells are available to the user and allow a variety of applications. Flow cell cartridges with standard and KNAUER LightGuide technology are available (see “Flow Cells” on page 61).

KNAUER LightGuide Flow Cell Cartridges KNAUER LightGuide flow cell cartridges combine a maximum light transmission (using total reflection) with a minimum cell volume to offer an ideal signal-to-noise ration.

Adapters for fiber optics are optionally available. Fiber optics allow separating the flow cell from the detector. This way, working with dangerous, explosive, or toxic materials becomes safer. Remote flow cells are recommended for preparative applications (high flow rates), in order to protect sensitive optical components from potential leakages.

Data Rate The detector measures with a maximum data rate of 100 Hz. During the measurement, approx. 100 spectra per second are recorded.

Leak Management Integrated leak management drains liquids from leaks.

GLP Data The Mobile Control, the Control Unit and the different software products (ClarityChrom® or OpenLAB®) can be used to display or read GLP data like operating hours, lamp operating hours, number of lamp ignitions, etc. You find a detailed description on how to display or read out GLP data in the respective user manuals.

Upgrade MWD 2.1L The multiwavelength detector can be upgraded to a diode array detector.

Optional Accessories The following optional accessories are available:

- Mobile Control app
- Control Unit

Eluents

Even small quantities of other substances, such as additives, modifiers, or salts can influence the durability of the materials. The list of selected solvents was compiled based on research in the pertinent literature and is only a recommendation by KNAUER. If there is any doubt, contact the Technical Support of the manufacturer.

Suitable Eluents
▪ acetate buffer solutions
▪ acetone at 4 °C-25 °C (39.2 °C-77.0 °F)[1]
▪ acetonitrile[2]
▪ benzene
▪ chloroform
▪ ethyl acetate
▪ ethanol
▪ formiate buffer solution
▪ isopropanol
▪ carbon dioxide (liquid 99.999 % CO_2)
▪ methanol
▪ phosphate buffer solutions (0.5 M)
▪ toluol
▪ ammoniated dilute solution
▪ acetic acid (0.1-1 %), at 25 °C
▪ sodium hydroxide (1 M)
▪ water

1. valid for the specified temperature range
2. not recommended in combination with PEEK small parts and PEEK capillaries

Less Suitable Eluents
▪ diethylamine (0.1 %) (DEA)
▪ dimethyl sulfoxide (DMSO)
▪ slightly volatile eluents
▪ methylene chloride[1]
▪ tetrahydrofuran (THF)[1]
▪ phosphoric dilute acid
▪ triethylamine (0.1 %) (TEA)
▪ trifluoroacetic acid (0.1 %) (TFA)

1. not recommended in combination with PEEK small parts and PEEK capillaries

Unsuitable Eluents
▪ halogenated hydrocarbons, e.g. Freon® ▪ concentrated mineral and organic acids ▪ concentrated bases ▪ eluents containing particles ▪ perfluorinated eluents, e.g. Fluorinert® FC-75, FC-40 ▪ perfluorinated polyether, e.g. Fomblin®

Scope of Delivery

Note Only use original parts and accessories made by the manufacturer or a company authorized by the manufacturer.

DAD 6.1L	detector with test cell
	power cable
	user manual German/English
	Installation Qualification
Accessories Kit	DAD 6.1L
	AZURA

DAD 2.1L	detector with test cell
	power cable
	user manual German/English
	Installation Qualification
Accessories Kit	DAD 2.1L
	AZURA

MWD 2.1L	detector with test cell
	power cable
	user manual German/English
	Installation Qualification
Accessories Kit	MWD 2.1L
	AZURA

Safety for Users

Professional Group

The user manual addresses persons who are qualified as chemical laboratory technicians or have completed comparable vocational training.

The following knowledge is required:

- Fundamental knowledge of liquid chromatography
- Knowledge regarding substances that are suitable only to a limited extent for use in liquid chromatography
- Knowledge regarding the health risks of chemicals
- Participation during an installation of a device or a training by the company KNAUER or an authorized company.

If you do not belong to this or a comparable professional group, you may not perform the work described in this user manual under any circumstances. In this case, please contact your superior.

Safety Equipment

When working with the device, take measures according to lab regulations and wear protective clothing:

- Safety glasses with side protection
- Protective gloves
- Lab coat

What must be taken into account?

- All safety instructions in the user manual
- The environmental, installation, and connection specifications in the user manual
- National and international regulations pertaining to laboratory work
- Original spare parts, tools, and solvents made or recommended by KNAUER
- Good Laboratory Practice (GLP)
- Accident prevention regulations published by the accident insurance companies for laboratory work
- Filtration of substances under analysis
- Use of inline filters
- Once they have been used, never re-use capillaries in other areas of the HPLC system.
- Only use a given PEEK fitting for one specific port and never re-use it for other ports. Always install new PEEK fittings on each separate port.
- Follow KNAUER or manufacturer's instructions on caring for the columns

More safety-relevant information is listed in alphabetical order in the following table:

Topic	Explanations
flammability	Organic solvents are highly flammable. Since capillaries can detach from their screw fittings and allow solvent to escape, it is prohibited to have any open flames near the analytical system.
solvent tray	Risk of electrical shock or short circuit if liquids get into the device's interior. For this reason, place all bottles in a solvent tray.
solvent lines	Install capillaries and tubing in such a way that liquids cannot get into the interior in case of a leak.
leaks	Regularly check if any system components are leaking.
power cable	Defective power cables are not to be used to connect the device and the power supply system.
self-ignition point	Only use eluents that have a self-ignition point higher than 150 °C under normal ambient conditions.
power strip	If several devices are connected to one power strip, always consider the maximum power consumption of each device.
power supply	Only connect devices to voltage sources, whose voltage equals the device's voltage.
toxicity	Organic eluents are toxic above a certain concentration. Ensure that work areas are always well-ventilated! Wear protective gloves and safety glasses when working on the device!

Where is use of the device prohibited?

Never use the system in potentially explosive atmospheres without appropriate protective equipment. For further information, contact the Technical Support of KNAUER.

Decommissioning the Device Securely

At any time, take the device completely out of operation by either switching off the power switch or by pulling the power plug.

Opening the Device

The device may be opened by the KNAUER Technical Support or any company authorized by KNAUER only.

Definition of Personal and Material Damage

Possible dangers related to the device are divided into personal and material damage in this user manual.

Category	Explanations
DANGER!	Lethal or very serious injuries can occur.
WARNING!	Serious or moderate injuries can occur.
CAUTION!	Moderate injuries can occur. Device defects can occur.

Decontamination

Contamination of devices with toxic, infectious or radioactive substances poses a hazard for all persons during operation, repair, sale, and disposal of a device.

DANGER!
Health danger if getting in contact with toxic, infectious or radio-active substances.
Before disposing of the device or sending it away for repair, you are required to decontaminate the device adequately.

All contaminated devices must be properly decontaminated by a specialist company or the operating company before they can be recommissioned, repaired, sold, or disposed of. All materials or fluids used for decontamination must be collected separately and disposed of properly.

Symbols and Signs

The following symbols and signs can be found on the device, in the chromatography software or in the user manual:

Warning Signs

Symbol	Meaning
	High-voltage hazard
	Electric shock hazard
	Toxic substances hazard.
	UV-light hazard, eye injuries can occur.
	Burn hazard, hot components.

Symbol	Meaning
	General warning sign. Moderate injuries can occur. General warning sign. Device defects can occur.
	Electrostatic discharge hazard, damages to system, device, or components can occur.
	Obey maximum load for leak tray during transportation, installation and operation.
Mandatory Signs	Wear protective gloves to avoid skin irritations.
CE Mark	A device or system marked with CE fulfills the product specific requirements of European directives. This is confirmed in a Declaration of Conformity.
	Testing seals in Canada and the USA at nationally recognized testing centers (NRTL). The certified device or system has successfully passed the quality and security tests.

Installation

This chapter describes all preparatory steps prior to the start-up. If you encounter difficulties during installation, contact the Technical Support.

Contact Data

Phone	+49 30 809727-111
Fax	+49 30 8015010
E-mail	support@knauer.net

Transport

Carefully prepare the device for transport or storage. If you want to return your device to KNAUER for repairs, enclose the Service Request Form which can be downloaded from our website.

Device Data For a secure transport, note the weight and dimensions of the device (see Technical Data).

CAUTION!
Damage to the device by lifting on protruding housing parts.
Lift the device on the side of the housing only.

Lifiting Clasp the device at its side panels and lift it out of the packaging. Do not hold onto front cover or leak tray.

Operating Environment

Only if the requirements for ambient conditions of the operating environment are met, can the intended use be ensured. You will find the ambient conditions under Technical Data and below.

CAUTION!
Defect of the device due to overheating possible.
- Set up the device in such a way that it is protected against exposure to direct sunlight.
- Keep at least 15 cm clear at the rear and 5–10 cm at each side for air circulation.

Space Requirements

- Position the device on a level and even surface.
- Protect the device against direct exposure to sunlight.
- Set up the device at a location not exposed to air drafts (A/C systems).
- Do not set up the device in the vicinity of other machines that cause floor vibrations.
- Lateral distance to other devices:
  - At least 5 cm if another device is set up on one side
  - At least 10 cm if further devices are set up on both sides
  - Leave the power plug on the rear of the device accessible to be able to disconnect the device from the mains.

Installation Site

- air humidity: below 90 % (non-condensing)
- temperature range: 4–40 °C; 39.2–104 °F
- Avoid sources of high frequencies near the device. High-frequency sources may compromise measuring values.

Earthquake Areas If you are located in an earthquake area, use the bore holes ① in the side panels to secure the device. The bore holes are located on either right or left side panel.

Fig. 5 bore holes of device

Space Requirements

- Side clearance to other devices:
  - At least 5 cm, if there is another device on one side.
  - At least 10 cm, if there are devices set up on both sides.
- At least 15 cm on the rear panel for the fan.

Setup

Before you set up the device, find a suitable place according to the requirements and remove the packaging as described in the following section.

Unpacking

Prerequisite Check packaging for damage caused during transportation.

Tool Utility knife

CAUTION!
Damage to the device by lifting on protruding housing parts.
Lift the device on the side of the housing only.

Process
1. Set up the package in such a way that you can read the label. Using the utility knife, cut the adhesive tape and open the packaging.
2. Remove the foam insert. Take out the accessory kit and the manual.
3. Open the accessory kit and check the scope of delivery. In case any parts are missing, contact the Technical Support.
4. Clasp the device from below, lift it out of the packaging and place it on its feet. Do not hold onto the front cover.
5. Check the device for signs of damage that occurred during transport. In case you notice any damage, contact the Technical Support.
6. Place the device in its site of operation and remove protective foil.

Next steps Store packaging and keep the included packing list for repeat orders.

Note The test cell is used during operation qualifications and must be stored.

Inserting the Flow Cell

Before taking a flow cell filled with solvent into operation, please make certain that the used eluent is miscible with that one used previously. Otherwise purge the flow cell with a medium miscible with both the eluents.

Prerequisites
- No flow cell or test cell is installed.
- The device is switched off.

Note Pay attention to the compatibility of the flow cells.

Practical Tip Unscrew the capillary for easier handling.

WARNING!
Irritation of retina through UV light! Concentrated UV light can leak out from the flow cell or the fiber optic connectors.
- Switch off the device or the lamps.

Procedure

Process	Figure
1. Place the flow cell into the opening and slide to the back until it clicks into place inside the device.	**Fig. 6 flow cell**

Next Steps Connect the capillaries.

Inserting the Flow Cell with Fiber Optics

KNAUER fiber optic cables are extremely robust and solarization-proof. Nevertheless fiber optic cables are sensitive to bending. The minimum bending radius is 100 mm (short term: 70 mm).

Observe the following regarding the use of fiber optics:

- UV light will cause the fiber optic to become blind with time (solarization), making them no longer suitable for use.
- Do not touch the ends of the fiber optic with your fingers, as this could falsify the measurement.
- Handle the fiber optic with care, avoid impacts or hard actions.
- Move the fiber optic carefully without using pressure or bending it.

The flow cells with fiber optics are connected via an adapter.

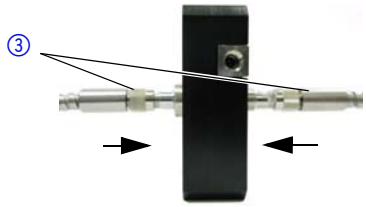
Prerequisites No flow cell or test cell is installed.

Auxiliary Material Screw-type cap fittings for the fiber optics

WARNING!
Irritation of retina through UV light! Concentrated UV light can leak out from the flow cell or the fiber optic connectors.
- Switch off the device or the lamps.

Note Fiber optical connectors, like all other optical parts, should never be touched without wearing gloves because otherwise contaminations may reduce light intensity. Contaminated parts may be cleaned with a soft cloth and isopropanol.

Procedure

Process	Figure
1. Remove the cap fittings ① from the adapter. 2. Place the adapter into the opening and slide to the back until it clicks into place inside the device.	 **Fig. 7 fiber optics adapter**
3. Remove the screw-type cap fittings ② from the fiber optics. 4. Manually, screw the fiber optics to the adapter.	 **Fig. 8 cap fitting on the fiber optics**
5. Remove the cap fittings from the flow cell. 6. Manually, screw the fiber optics ③ to the flow cell.	 **Fig. 9 fitting of the fiber optics on the flow cell**

Next Steps Connect the capillaries.

Connecting the Capillaries

Capillaries connect the detector with the column and guide liquids. For the flow cell connectors, we recommend PEEK capillaries and PEEK fittings.

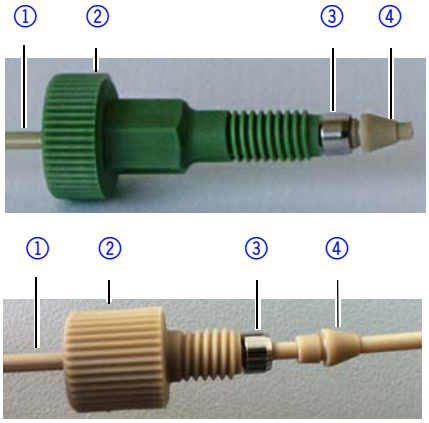
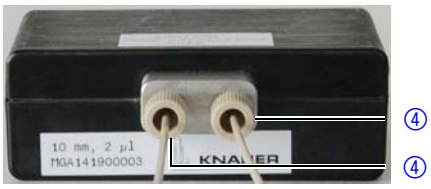
Prerequisites
- The flow cell was inserted.
- Screw-type cap fittings and cap fittings were removed.

Procedure Attach the capillaries with screw fittings.

Note The KNAUER LightGuide flow cell cartridges have unisex input and output connections.

CAUTION!
Damage to the flow cell caused by strongly tightened fittings!
Check the torque of screw fittings:
- 5 Nm for stainless steel fittings
- 0.5 Nm for PEEK fittings

Procedure

Process	Figure
1. Push the capillary ① through the fitting ② . 2. Slide the lock ring ③ over the tubing. Note that the tapered end of the lock ring has to point to the seal ring ④ . 3. Attach the seal ring ④ .	 **Fig. 10 capillary fittings**
4. Fasten the capillary at the flow cell ④ finger-tight.	 **Fig. 11 flow cell with capillary**

Next Steps Bring the device into operation.

Using the PEEK Fittings

PEEK fittings withstand a maximum pressure of 400 bar. Note the torque of 0.5 Nm.

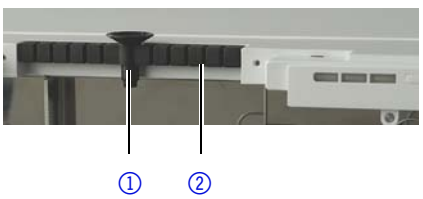
Connecting the Leak Management

The leak management consists of the leak sensor and the drainage system. The drainage system ensures that escaping liquids flow into a waste bottle. If there is too much liquid, the red LED starts flashing. Both the device and the data acquisition via chromatography software are stopped.

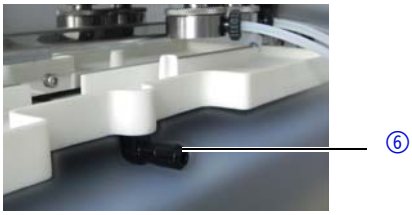
Prerequisite

- The front cover has been removed.

Procedure

Process	Figure
1. Carefully push the funnel ① into the center opening of the capillary guide ② .	 **Abb. 12 Funnel and capillary guide**

Procedure

Process	Figure
2. Push the long ending of the first nozzle ④ into the hose ③ .	**Abb. 13 Hose and nozzle**
3. Connect the nozzle and the funnel. 4. Push the other end of the hose onto the nozzle ⑤ of the leak tray.	**Abb. 14 Hose connected to device**
5. For the bottom device, push the short end of the nozzle ⑥ into the opening in the collection point of the leak tray. 6. Connect the hose to the nozzle and lead the second ending to the waste bottle. 7. Place the waste bottle below the bottom device.	 **Abb. 15 Leak tray with nozzle**

Next steps Attach the front cover.

Control

The detector can be operated in two ways:

- via remote connector
- as part of a LAN, via the LAN connector of the router

All connectors for external control are located on the rear side of the detector.

The detector can also be controlled via Control Unit or Mobile Control. The Control Unit connector is located on the side of the device.

Legend

① integrator outlets

② LAN connector

③ service interface

④ multi-pin connector

Fig. 16 connectors on rear side

① USB port for the Control Unit

Fig. 17 USB port for the Control Unit

Connecting the Device to the Computer

This section describes how to set up an HPLC system in a local area network (LAN) and how a network administrator can integrate this LAN into your company network. The description applies to the operating system Windows® and all conventional routers.

Note To set up a LAN, we recommend to use a router. That means the following steps are required:

Process

1. On the computer, go to the control panel and check the LAN properties.
2. Hook up the router to the devices and the computer.
3. On the computer, configure the router to set up the network.
4. Install the chromatography software from the data storage device.
5. Switch on the device and run the chromatography software.

Configuring the LAN Settings

The LAN uses only one server (which is normally the router) from that the devices automatically receive their IP address.

Prerequisite

- In Windows®, power saving, hibernation, standby, and screen saver must be deactived.
- In case you use an USB-to-COM box, the option "Allow the computer to turn off ths device to save power" in the device-manager must be deactivated for all USB hosts.
- Only for Windows 7: For the network adapter, the option "Allow the computer to turn off this device to save power" in the Device Manager must be deactivated.

Procedure

1. In Windows 7 choose *Start* ⇒ *Control Panel* ⇒ *Network and Sharing Center*.
2. Double-click on *LAN Connection*.
3. Click on the button *Properties*.
4. Select *Internet Protocol version 4 (TCP/IPv4)*.
5. Click on the button *Properties*.
6. Check the settings in the tab *General*. The correct settings for the DHCP client are:
   a) *Obtain IP address automatically*
   b) *Obtain DNS server address automatically*
7. Click on the button *OK*.

Connecting the Cables

A router has several LAN ports and one WAN port that can be used to integrate the LAN into a wide area network (WAN), e.g. a company network or the Internet. In contrast, the LAN ports serve to set up a network from devices and a computer. To avoid interference, we recommend operating the HPLC system separately from the company network.

You will find patch cables for each device and the router in the accessories kit. To connect the router to a WAN, an additional patch cable is required, which is not supplied within the scope of delivery.

① Modules
② Router
③ LAN ports
④ WAN port
⑤ Workstation

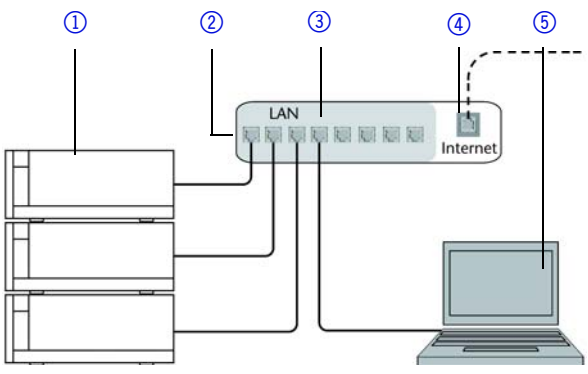


Fig. 18 Cabling system LAN

Prerequisite
- The computer has been switched off.
- There is a patch cable for each device and the computer.

Procedure
1. Use the patch cable to connect the router and the computer. Repeat this step to connect all devices.
2. Use the power supply to connect the router to the mains power system.

Configuring the Router

The router is preset at the factory. You will find a label at the bottom side of the router, on which IP address, user name, and password are printed. These information help to open the router configuration.

Procedure
1. To open the router configuration, start your Internet browser and enter the IP address (not for all routers).
2. Enter user name and password.
3. Configure the router as DHCP server.
4. In the router configuration, check the IP address range and make changes if necessary.

Result Once the router has assigned IP addresses to all devices, the chromatography software can be used to remotely control the system.

Integrating the LAN into a Company Network

A network administrator can integrate the LAN into your company network. In this case you use the WAN port of the router.

Prerequisite There is a patch cable for the connection.

Procedure
1. Check that the IP address range of the router and of the company network do not overlap.
2. In case of an overlap, change the IP address range of the router.
3. Use the patch cable to connect the router WAN port to the company network.
4. Restart all devices, including the computer.

Controlling Several Systems Separately in a LAN

Devices connected to a LAN communicate through ports, which are part of the IP address. If more than one HPLC system is connected to the same LAN and you plan on controlling them separately, you can use different ports to avoid interference. Therefore, the port number for each device must be changed and this same number must be entered into the device configuration of the chromatography software. We recommend to use the same port number for all devices in the same system.

Note The port is set to 10001 at the factory. You must use the same numbers in the device configuration of the chromatography software as in the device, otherwise the connection fails.

Procedure
1. Find out port number and change it on the device.

2. Enter the port number in the chromatography software.

Result The connection is established.

Using Remote Control

On the rear panel of the detectors an electrical connector socket is located which serves to send or receive signals from other instruments. For example start signals from an injection valve or an autosampler can be put to the START input. All voltages have to be mounted between GROUND and the corresponding event.

CAUTION!
Electrostatic discharge can destroy the electronics. Wear a protective bracelet against electrostatic discharge and ground.

For test purposes or in some other cases, it can make sense to manually enter these signals.

- sending control signals *(Events)* to external devices
- opening and closing contacts
- activating 500 ms pulses

The following remote signals can be received and sent:

- for receiving start, control, and error signals from external devices
- for sending start, control and error signals to external devices

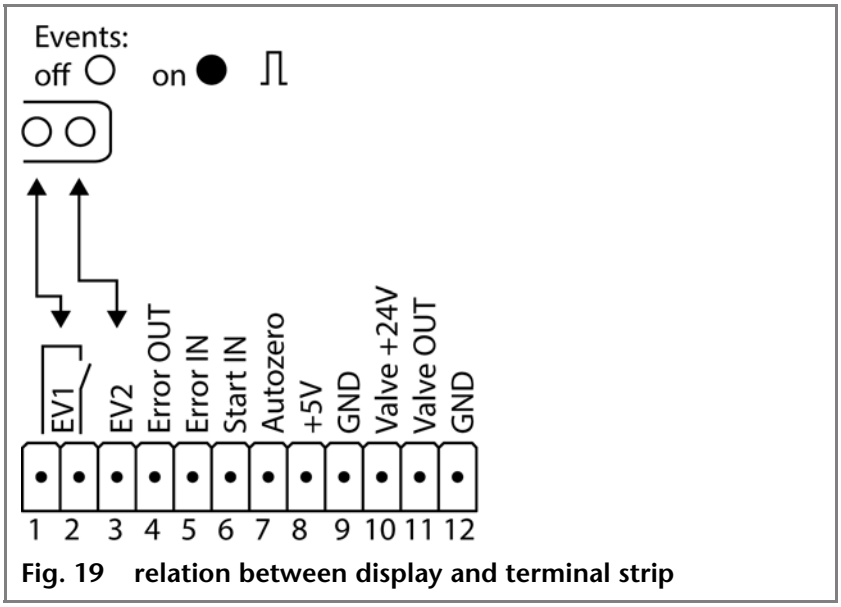
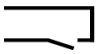


Fig. 19 relation between display and terminal strip

Connections to the Terminal Strip

Connection	Function
 EV 1 (Event 1)	**Relay Contact** The contact is on a floating basis. Its setting depends on the settings in the Control Unit, Mobile Control, or software. Steady-rate signal: ▪ passive = open relay contact ▪ active = closed relay contact Pulse: ▪ Closed relay contact for at least 1000 ms Permissible load of the relay contact: 1 A/ 24 V DC
EV 2 (Event 2)	**TTL Output** Levels: ▪ passive 5 V ▪ active 0 V Pulse: ▪ 0 V for at least 1000 ms
Error OUT	**TTL Output** Levels: ▪ passive 5 V ▪ active 0 V Output is active until the Error condition has been eliminated.
Error IN	**TTL Input** ▪ Low active Secure switching threshold at least 10 mA After receiving a signal (short-circuit to ground) from an external device, an error message appears and the device stops.
Start IN	**TTL Input** ▪ Low active Secure switching threshold at least 10 mA After receiving a signal (short-circuit to ground) from an external device, the device starts. If controlled with software, an electronic trigger is send through the LAN.

Connection	Function
Autozero	**TTL Input** ▪ Low active Secure switching threshold at least 10 mA A signal (short-circuit to ground) sets the measuring signal to zero.
+5 V	Provides a voltage of 5 V with respect to GND. This makes it possible to supply a load that is switched by an EVENT. Protection: 5 V–50 mA
GND	Reference point of the voltage at the signal inputs.
+24 V Valve	Event-controlled switching of 24 V against GND Protection: 24 V–200 mA
Valve OUT	Output is active until the valve condition has been eliminated.
GND	Reference point of the voltage at the signal inputs.

Connecting Cables to the Terminal Strip

To control one device through another, you use the multi-pin connector. To use remote control, you have to connect cables to the terminal strip (everything comes included with delivery). The single ports are used to exchange control signals.

Prerequisites

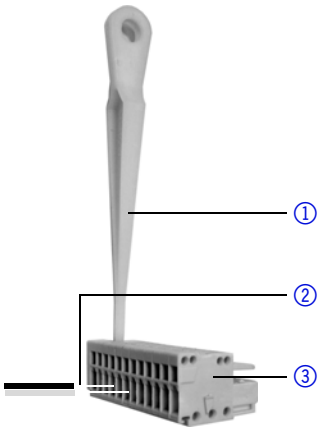
- The device has been turned off.
- The power plug has been pulled.

Tools Depressor tool

CAUTION!
Short-circuit hazard.
- Turn off the device before connecting it to the multi-pin connector.
- Pull the power plug.

CAUTION!
Electrostatic discharge can destroy the electronics.
Wear a protective bracelet against electrostatic discharge and ground.

Procedure

Process	Figure
1. Place the terminal strip ③ on a suitable surface. 2. Push the depressor tool ① into the opening on the upper side. 3. Continue pushing the depressor tool down and lead the cable ② into the front end of the terminal strip. 4. Remove the depressor tool. 5. Check whether the cables are tightly attached. 6. Plug the terminal strip onto the multi-pin connector.	 **Fig. 20 terminal strip**

Next steps Finish the installation and perform the initial startup.

Integrator Connector

The integrator output supplies the current signal value as an analog voltage (max. 5 V). The integrator output is connected to other instruments with the analog connection cable or other special connection cables.

For details on the integrator connector, see the list below:

- non-bipolar
- 4 channel
- 0 to 5 V
- DAC 16 bit
- scalable
- Adjustable to offset

Power Connection

Note The nominal capacity of the connected devices must be maximum 50 % of the power supply to account for larger inrush currents when switching on the modules.

The maximum power input is 75 W.

Prerequisites

- The electrical power supply at the installation site must be connected directly to the nearest main power line.
- The power must be free from ripple, residual current, voltage peaks and electromagnetic interference.
- The connectors for the mains voltage are grounded accordingly.
- The device receives sufficient power with reserve capacity

The device is intended for use with AC power networks of 100 – 240 V.

Power Cable

Only the supplied power cable is to be used to connect the device to the mains supply. Replace defective power cables only with accessories from KNAUER. Only use power cables with a permission for use in your country.

In case of queries contact the Technical Support.

CAUTION!
Electric hazard if the device is turned on while connecting or interrupting the power connection.
Switch off the device beforehand.

Power Plug

Make sure that the power plug on rear of the device is always accessible, so that the device can be disconnected from the power supply.

Next Steps

Finish the installation and connect the device to the mains.

Integrating the Detector into the System

To integrate the detector into a system, note the ambient conditions found in the section Technical Data as well as the ambient conditions of other devices to be integrated into that system.

The detector is integrated into the HPLC flow system by connecting the capillary to the flow cell and the HPLC system.

Procedure

Stainless steel fittings are tightened with 5 Nm, PEEK fittings are tightened with 0.5 Nm.

Capillary Layout

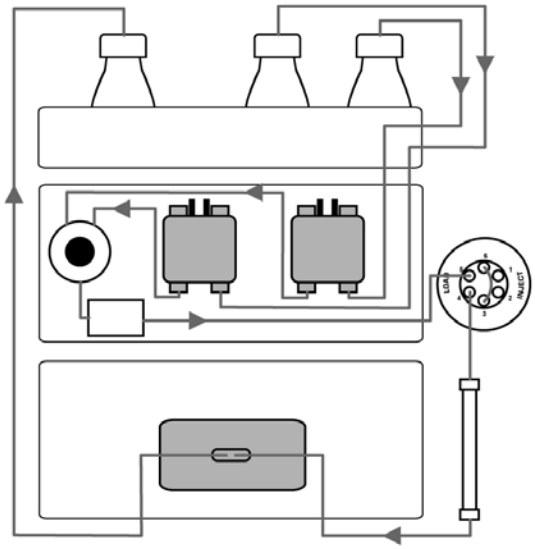


Fig. 21 installation for detector

Pre-Installed Capillaries

Pre-installed stainless steel and PEEK capillaries are color-coded according to their inner diameter.

Color	Material	Inner Diameter
red marker	stainless steel	0.1 mm
blue marker	stainless steel	0.25 mm
black marker	stainless steel	0.4 mm
red marker	PEEK	0.1 mm
blue marker	PEEK	0.25 mm
orange marker	PEEK	0.5 mm

Note PEEK capillaries are not suitable for use with pure acetonitrile. Acetonitrile can cause capillaries to crack or rupture.

Operation

In this chapter, you find the information relevant for operating the detector.

Initial Start Up

Use this checklist to determine whether the detector is ready for initial start-up:

- Device is positioned in the correct location.
- The power plug has been connected.

If the device is part of an HPLC system, you should also note the following:

- The network connection to the router is established
- The chromatography software has been installed by KNAUER or a company authorized by KNAUER.
- A flow cell was inserted.
- The capillaries have been connected.

Switch On

Prerequisites

- Installation has been completed.
- A flow cell was inserted.

CAUTION!
Possible damage to the device caused by condensed water!
Allow device to acclimate for 3 h, before it is connected to power supply and taken into operation.

Procedure

Process	Figure
1. On the rear of the device, plug the power cable into the power connector ②. 2. Plug in the power supply. 3. On the rear of the device, switch on the detector using the power switch ①.	**Fig. 22 power switch with female connector at the rear panel**

Result The detector starts its self-validation. If the self-validation has been successfully completed, the LEDs on the right and in the center light up green.

Next Steps Bring the detector into service.

Operation

There are several options for controlling the device:

- with chromatography software
- with Control Unit
- with Mobile Control

Note It is not possible to use 2 control methods simultaneously. If the device is connected to the software, it cannot be controlled via Control Unit or Mobile Control. The device status can however be monitored.

Operating with Chromatography Software

To control the device with software, you have to establish a connection between the LAN port and a computer.

Devices can be controlled with e. g. OpenLAB EZChrom edition version A.01.05/A.04.05 or higher or ClarityChrom version 5.0.3 or higher (DAD 6.1L) or version 5.0.5 or higher (DAD 2.1L, MWD 2.1L). You find a detailed description on chromatography software in the corresponding user manual.

Operating with Control Unit

The Control Unit is an optional accessory. To control the device using the Control Unit, connect the cable of the Control Unit to the device. You find a detailed description on the Control Unit in its accompanying user manual.

Operating with Mobile Control

The Mobile Control is an app which can be installed on your computer or tablet. To control the device using the Mobile Control, connect the computer or tablet to a wireless LAN router. Data transfer between device and app is actualized through

wireless LAN. You find a detailed description on the Mobile Control in its accompanying user manual.

Meaning of the LEDs

There are three LEDs and a switch on the front of the device.

① Left LED

② Center LED

③ Right LED

④ Switch/Standby button

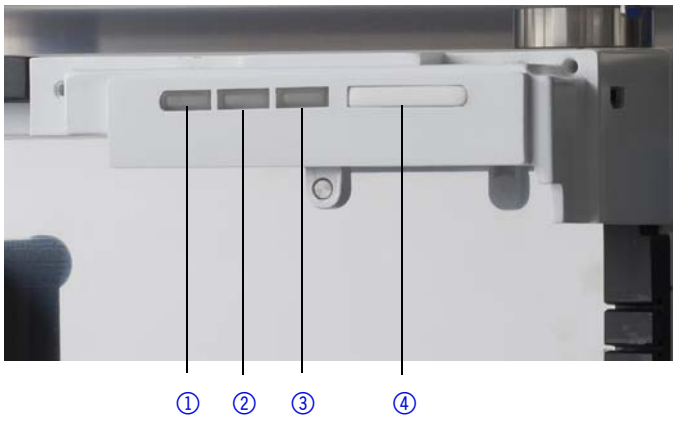


Fig. 23 LEDs and switch/standby button on the front of the device

The LEDs can have different colors depending on the operating conditions.

Standby To start the standby, keep the standby button pressed for 5 seconds.

Note Malfunctioning system after repeated standby possible. After repeatedly using standby, restart the device using the power switch to reset the device's data storage.

	Color	Status	Operation
Left LED	red	Error Message	▪ Check the system ▪ Shortly press the switch to deactivate the error message.
	green	3D data are acquired.	
Center LED	does not light	The lamp has been switched off.	
	flashes green	The lamp/lamps are initializing or the validation is progressing.	▪ Wait until the lamp is running or the validation is finished.
	green	The deuterium lamp is active.	

	Color	Status	Operation
Right LED	green	The device has been switched on.	
	flashes green	The device not ready for operation.	▪ Wait until the device is ready for operation.
	blue	The device is in standby	▪ Press the standby button to end the standby.

Resetting the Device

Using the Control Unit, you can re-set the detector to its default settings.

Parameter	Setting
Network	LAN DHCP, port 10001
Lamps	D2 ON, Halogen OFF
Time constant	2 s
Channels	Channel 1: WL = 254 nm, BW = 8 nm
Reference correction	Reference channel enabled for channel 1, WL = 360 nm, BW = 30 nm
Analog out	Offset 1 = 0.00 mV, Scale 1 = 1 AU/V
Flow Cell	Test cell
Event check	All events deactivated (o)
Date/Time	Current date/time
Wake-up	Current date/time
Leak sensor	ON, Sensitivity = low

Optimizing the Detector

In this chapter, you find information on how to optimize your detector.

Location

In order to ensure thermo stability and to prevent drift effects, note the following aspects:

- Protect the detector against strong ventilation.
- Protect the detector against direct sunlight.
- Note the space requirements.
- Avoid vibrations.

Warm Up Time

The recommended warm-up time for the detectors is 30 minutes. This recommendation is applicable after turning the detector on as well as and after turning the lamp/s on.

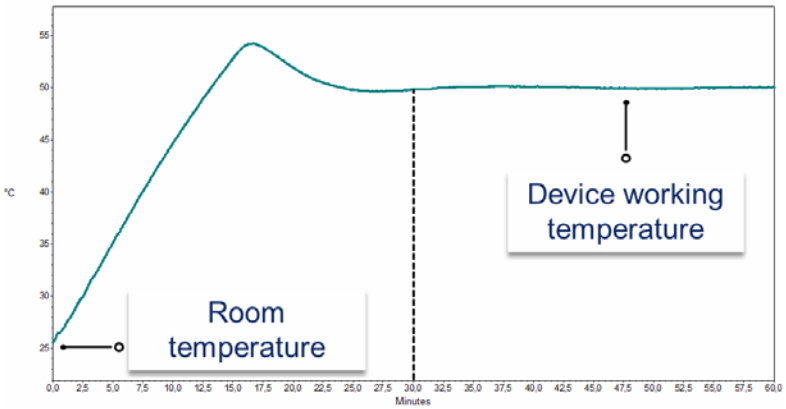


Fig. 24 cold start temperature profile

Selecting the Flow Cell

Several different flow cells are available for the detector (see “Flow Cells” on page 61). Note that the detector is shipped with a test cell. A flow cell must be ordered separately.

Signal sensitivity, peak broadening and response can all be affected by the choice of flow cell. Volume, path length as well as wetted parts, required pressure range, flow cell connection, and remote operation are further factors that need considering when selecting a flow cell.

Flow Cell Volume

Depending on your instrument setup, column and sample(s), one flow cell volume may be more appropriate that another. If the volume is too large, two adjacent peaks may get mixed in the cell. If the volume is too small, the noise may be higher and the signal may be too small due to less light reaching the photodiodes.

Ideal flow cell volume therefore is a compromise between peak broadening and sensitivity (see figure 25).

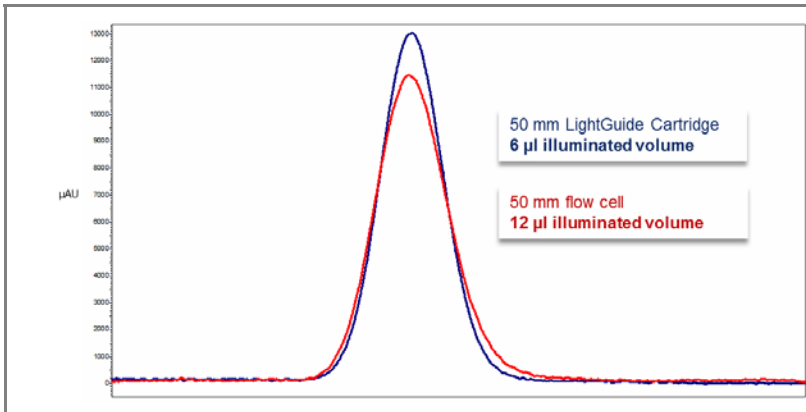


Fig. 25 volume comparison

A good rule of thumb is that the flow cell volume should not be more than 1/3 of the peak volume of your separated sample. To determine the volume of your peaks, take the peak width as reported in the integration results, multiply it by the flow rate and divide it by 3.

Cartridge flow cells with volumes of 2 µl, 6 µl and 10 µl are available for the detectors. Narrow-bore columns (~ 2,1 mm ID) are suitable for flow cells with smaller volumes. Columns with with a larger inner diameter ($\geq$ 3,0 mm ID) are less affected by the volume of the flow cell.

The flow rate should also be taken into consideration. A lower flow rate increases the axial and longitudinal diffusion and adds to a broadened flow profile which may lead to a peak broadening.

Path Length

As described by the Beer-Lambert law, the path length of a flow cell affects the light intensity that is detected.

$$A = -\log T = \log\left(\frac{I}{I_o}\right) = \varepsilon \times d \times c$$

Fig. 26 Beer-Lambert law

A:	measured absorption at a given wavelength
T:	transmittance, defined as the quotient of the light intensity (I) after passing through the sample and the initial light intensity (I_0) before passing through the sample
ε:	molar absorptivity coefficient (wavelength and temperature dependent)
b:	path length
c:	analyte concentration (temperature-dependent)

For the same concentration, the peak height will be higher if the path length is longer. Path lengths of 3 mm, 10 mm, and 50 mm are available for the detectors. A longer path length, therefore, increases the sensitivity of a method (see figure 27). The limit of detection is inversely proportional to the path length.

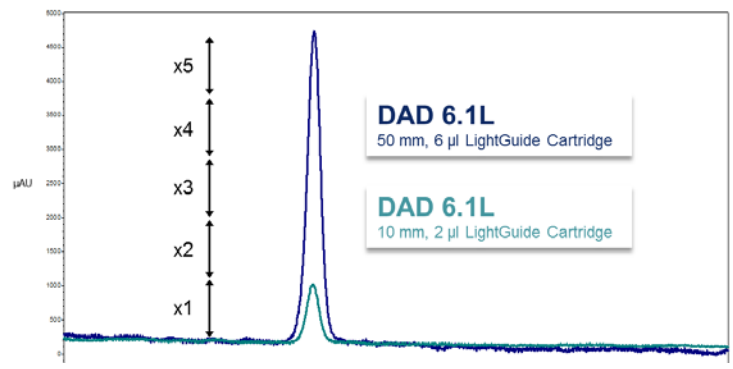


Fig. 27 path length comparison

Wetted Parts

The flow cell materials must be chemically compatible with the solvents and sample you are working with. Stainless steel and metal-free flow cells are available. The metal-free variants are bio-inert.

Pressure Stability

The different flow cells can withstand various maximum pressures. The upper pressure limits of the flow cells are 30 bar, 100 bar, or 300 bar. The flow cell should not be subjected to the maximum pressure for a long period of time.

Connection

Undesired effects, like the loss of resolution in the chromatogram, may be prevented by ensuring a correct connection to the flow cell and the removal of any dead volume.

Remote Operation (Fiber Optics)

If the flow cell must be positioned outside of the detector (e.g. in an explosion-proof room, at higher temperatures such as in an oven, or in an environment with radioactive substances), the devices can be optionally equipped with fiber optic connectors. Remote flow cells are recommended for preparative applications (high flow rates), in order to protect sensitive optical components from potential leakages.

For detectors with fiber optic cables the light intensity does not depend just on the lamp and the cell but also on the quality / condition of the fiber optic cables, the quality of the connections, the length of the fiber optic cables, the number of bends and the bending radius.

Sensitivity is typically reduced to half that of an equivalent standard cell when working with standard length fiber optic cables (750 mm). Overall, sensitivity is inversely proportional to the length of the fiber optic cables.

Temperature changes around the cables may cause additional drift.

Selecting the Wavelength

Signal Wavelength

Wavelength selection can influence the sensitivity, selectivity and linearity of a measurement. The measurement wavelength can be selected within the range from 190–1000 nm for the DAD 6.1L or 190–700 nm for the DAD 2.1L and MWD 2.1L in 1 nm steps. The best wavelength for a given measurement (signal wavelength) is that which fives the maximum absorption above the UV cutoff of the mobile phase. In cases where there are multiple components with different absorbance maxima, a compromise wavelength must be chosen where all components absorb.

Baseline Correction / Reference Wavelength

In order to minimize baseline drift due to refractive index effects, a reference wavelength can be set in order to correct the baseline (see figure 28). The reference should be set in the same spectral region as the signal wavelength (UV or Vis) but at a wavelength at which the analyte has no absorbance.

Default Reference Wavelength

By default, the reference wavelength 360 nm is activated. This is a suitable value for most applications.

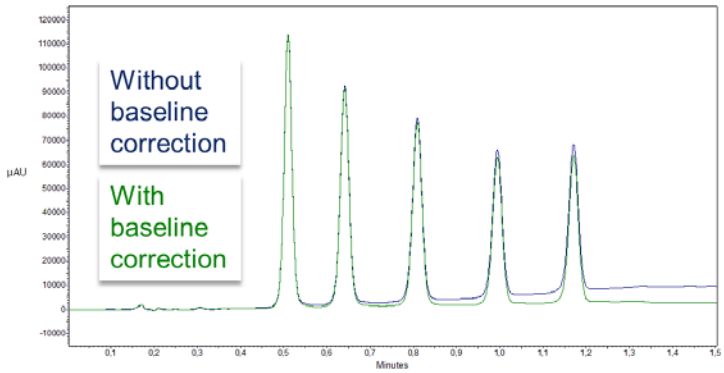


Fig. 28 comparison with and without baseline correction

When selecting the signal and reference wavelengths, the respective bandwidths must also be selected (see the following section).

Bandwidth

The bandwidth defines the total number of wavelengths actually registered by the photodiode when a specific wavelength is set. For example, a wavelength set at 254 nm width a bandwidth of 4 nm results in average absorption of 252-256 nm.

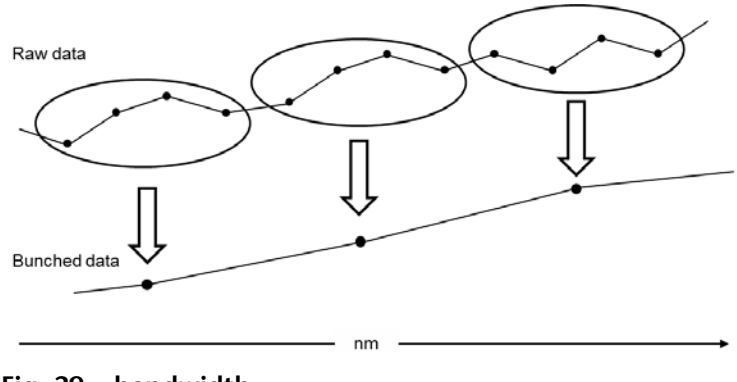


Fig. 29 bandwidth

The selection of bandwidth is a balance between sensitivity and selectivity. Narrow bandwidths increase selectivity, whereas broad bandwidths increase sensitivity.

Default Bandwidth

By default (see “Resetting the Device” on page 32), the bandwidth for the signal wavelength is set to 8 nm and for the reference wavelength the bandwidth is set to 30 nm.

Spectral Range

When measuring with chromatography software, the spectral range selected for a given measurement influences the required disc space. The disc space is necessary to save generated data.

A narrow spectral range reduces disk space. The range, however, should be wide enough to ensure the detection of all com-

ponents. Also, the spectral range always must include the signal wavelength and the reference wavelength (when applicable).

Time Constant & Data Rate

Response Time

The time constant influences the response time of the detector. The response time determines how quickly the detector responds to a change in signal. A good rule of thumb for selection of the time constant is that it should be no larger than $\frac{1}{10}$ of the baseline peak width of the first peak of interest (in seconds). Increasing the time constant allows more averaging of the signal (also known as digital filtering) and results in less baseline noise. However, increasing the time constant too much may result in broad peaks, reduced peak heights and asymmetric peak shapes. Therefore, a compromise has to be found.

Time Constant

Using the time constant a signal smoothing can be achieved. The larger this value is set, the more the signal will be smoothed. In general, the best time constant is the reciprocal of the data rate (see table below). If increased sensitivity is desired, or if the baseline noise is interfering with integration, the time constant should be increased. If resolution is compromised, it should be decreased.

It is recommended to set the time constant and data rate in relation to peak width.

Peak Width	**Time Constant**	**Data Rate**
[min]	[s]	[Hz]
<**0.003**	0.01	100
>**0.007**	0.02	50
>**0.017**	0.05	20
>**0.033**	0.1	10
>**0.067**	0.2	5
>**0,167**	0.5	2
>**0,333**	1	1

Data Rate

The data rate (or sampling rate) is the number of data points per second (Hz) at which the detector transmits data to the computer.

Default Data Rate

The default data rate setting for the detectors is 1 Hz (see “Resetting the Device” on page 32). The maximum data rate (digital signal) is 100 Hz. Lower data rates store average data points. A 50 Hz data rate averages 2 points. A 10 Hz data rate averages 10 points. The analog data rate is fixed at 12.5 Hz.

Optimizing the Data Rate

The optimal data rate depend on your application. Too few points across a peak (short data rate) decrease detail and compromise reproducibility. Too many points (high data rate) intro-

duce noise into the system and the resulting files can become very large. Some general considerations are listed below:

- Each peak should be defined by 20-30 data points. For chromatograms with co-eluting peaks or low signal-to-noise ratios, 40-50 data points per peak are recommended.
- If all peaks are relatively wide, select a slower data rate.
- If any peaks of interest are less than a few seconds, select a faster data rate.
- If the data rate is too slow, the start and end points of the peaks are not accurately determined. If the data rate is too fast, data files may occupy excessive disk space and post-run analyses may require more processing time.

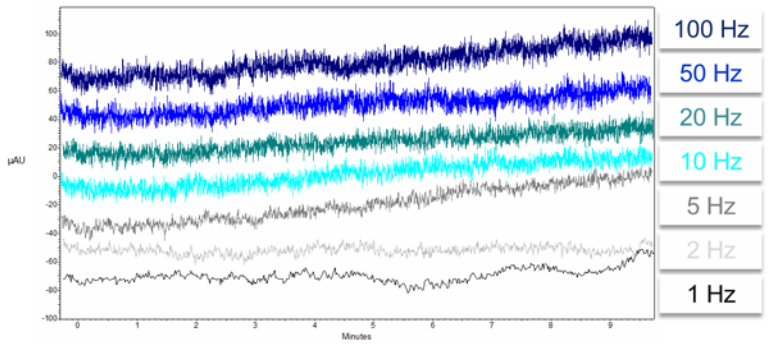


Fig. 30 noise with different data rates

Integration Time

Signal Level

The integration time influences the intensity of the signal and therefore the sensitivity of the measurement. The larger the integration time, the higher the intensity of the signal until the maximum sensor counts are reached. The integration time is automatically calculated by the software before the start of a measurement. The calculations are in relation to the special range (see section).

When a narrower spectral range is selected, the signal intensity will be increased. This increase is limited, however, by the data rate.

Subtraction of the Baseline Chromatogram

The baseline subtraction can eliminate the effects of drift that result from solvent, gradient, or flow programming. The baseline profile is subtracted from the measured chromatogram. This results in a mathematically reprocessed chromatogram with an ideally flat baseline.

General

- The performance of the detector is largely dependent on the performance of the HPLC system.
- Noise can be related to pump stability, the flow cell cleanliness, lamp quality, mobile phase composition and other factors.
- Drift is usually related to long-term changes in the environment, such as detector warm-up or fluctuations in temperature and mobile phase composition.

Functionality Tests

Installation Qualification **(IQ)**

The customer may request the Installation Qualification, which is free of charge. In case of a request, the Technical Support of KNAUER or from a provider authorized by KNAUER performs this functionality test during the installation. The Installation Qualification is a standardized document that comes as part of the delivery and includes the following:

- confirmation of flawless condition at delivery
- check if the delivery is complete
- certification on the functionality of the device

Operation Qualification **(OQ)**

The Operation Qualification includes an extensive functionality test and must be purchased from the manufacturer. Contact the KNAUER Sales Department to request an offer. The Operation Qualification is a standardized KNAUER document and includes the following:

- definition of customer requirements and acceptance terms
- documentation on device specifications
- device functionality check at installation site

Test Intervals

To make sure that the device operates within the specified range, you should test the device using the Operation Qualification at following intervals:

Average Useful Life	OQ Test
1 to 5 days/week:	Every 6 months
More than 5 days/week or 24 hours/day:	Every 3 months
Operation with buffer solutions or other salt solutions:	Every 3 months

Execution

The test can be carried out either by the Technical Support of KNAUER or from a provider authorized by KNAUER.

Troubleshooting

First Measures

1. Check all cabling.
2. Check all screw fittings.
3. Check whether air has gotten into the supply lines.
4. Check device for leaks.
5. Pay attention to system messages.

LAN

Go through the following steps, in case no connection between the computer and the devices can be established. Check after each step if the problem is solved. If the problem cannot be located, call the Technical Support.

1. Check the status of the LAN connection in the Windows task bar: - Connected - Connection not established If no connection was established, test the following: ▪ Is the router switched on? ▪ Is the patch cable connected correctly to the router and the computer?	☐
2. Check the router settings: ▪ Is the router set to DCHP server? ▪ Is the IP address range sufficient for all the connected devices?	☐
3. Check all connections: ▪ Are the patch cable connected to the LAN ports and not the WAN port? ▪ Are all cable connections between devices and router correct? ▪ Are the cables plugged in tightly?	☐
4. If the router is integrated into a company network, pull out the patch cable from the WAN port. ▪ Can the devices communicate with the computer, even though the router is disconnected from the company network?	☐
5. In case you own a Control Unit, check the settings in the menu *Setup* > *Network*. ▪ Is *LAN-DHCP* set for controlling? ▪ Did the device receive an IP address?	☐
6. Turn off all devices, router, and computer. Firstly, turn on the router and secondly turn on the devices and the computer. ▪ Has this been successful?	☐

7. Replace the patch cable to the device with that no connection could be established. ▪ Has this been successful?	☐
8. Make sure that the IP port of the device matches the port in the chromatography software.	☐

Possible Problems and Rectifications

Problem	Solution
Baseline drift	Maintain constant temperature conditions during the measurement.
Device cannot be switched on	Inspect the power cable to ensure that it is plugged into the power supply.
Device cannot be calibrated	1. Insert the test cell. 2. Inspect the calibration with a weak absorbing eluent.
Baseline noise	1. Inspect the flow-cell assembly. 2. Exchange the defective flow cell. 3. Inspect the service life of the lamp on the display. 4. Reduce the air in the flow cell by using a degasser.
The relationship of the signal to the light path reference is very low	1. Flush the flow cell. 2. Replace the lamps

Further Measures

- Install the maintenance software (service tool).
- Save device information and send to manufacturer.
- Inform the Technical Support of KNAUER.

System Messages

If other system messages are displayed besides those listed below, please turn the device off and then on. Inform the Technical Support of the manufacturer in case the system message repeats itself.

The system messages are in alphabetical order:

System Message	Problem and Solution
"Ambient temperature sensor failed"	Temperature sensor on the mainboard was not found or does not react.
"Cannot initialize LAN"	Check cables and connections in local area network.

C

System Message	Problem and Solution
“Instrument not validated”	Data acquisition or simple scans can not be executed, if the system has not been validated.
“Cannot proceed: D2 lamp heating”	Manual validation is not possible while lamp is heating up. Wait until deuterium lamp has initialized and continue afterwards.
“Cannot proceed: D2 lamp off”	Manual validation is not possible while lamp is switched off. Switch the lamp on. In case the error shows again, restart the device. In case no improvement shows, replace the lamp.
“Cannot proceed: Low light”	Validation failed because of exceeded integration time. The operating time of the lamp has been exceeded. Replace the deuterium lamp. Flow cell is dirty. Clean the flow cell. Error state of the optical system. Inform the Technical Support of KNAUER.
“D2 lamp failed”	Manual validation is not possible without deuterium lamp.
“Communication buffer overflow”	Communication via RS-232 is interrupted.
“Communication timeout”	Timeout: Connecting error RS-232 (5 s), leak sensor (0,5 s) or any hardware component (lamp power connection, EPROM, I2C with GUI).
“CRC failure”	Correct input, connection interrupted (currently inactive)
”D2 lamp operation failed”	Restart the device. If the error occurs again, replace the lamp.
”D2 lamp does not start”	Switch off lamp and turn on again. In case the system message repeats itself, inform the Technical Support of KNAUER . The lamp unit has to be replaced. No lamp ignition when starting the device or the manual validation.
”Data acquisition active”	No entries are possible. First stop acquiring measurement data, afterwards you can make a new entry.

	System Message	Problem and Solution
E	"Error input activated"	External error, outside the device: Check the external devices and cable connections. Check the system to locate and remove the error.
H	"HAL lamp does not start" (DAD 6.1L)	Switch the lamp on. In case the error shows again, restart the device. In case no improvement shows, replace the lamp.
I	"Instrument busy"	3D data is being collected while scanning, leak sensor or cover are processing earlier inputs. Wait until the device has completed the process.
	"Instrument in standby mode"	Command not allowed during standby mode.
	"I2C lamp(s) operation failed"	Connecting error between power source of lamp and I2C.
	"I2C operation failed"	Connecting error for power source of leak sensor or lamp at firmware upload or via EEPROM I2C
	"Instrument in standalone mode"	Command can not be executed in local operation (only in remote operation)
	"Instrument remote controlled"	This entry is not executable. Quit software.
	"Insufficient access for operation"	Data on lamp power supply can not be processed (activate service mode).
	"Invalid command"	Check the cable connections. Change the entry. Wrong command was transmitted to the device. Check if the command is valid.
	"Invalid parameter(s)"	Correct command, incorrect parameters. Check if the parameters are valid.
L	"Lamp cover open"	The lamp cover was mounted incorrectly or the micro switch is malfunctioning. Mount the lamp cover. In case the system message repeats itself, inform the Technical Support of KNAUER .
	"Lamp not installed"	GLP data can not be read and lamp operation can not be executed, as the lamp (D2 or halogen) has not been installed.

	System Message	Problem and Solution
	“Lamps off”	Command can not be executed, as the lamps are being switched off.
	“Lamp supply is not available”	Power supply of lamp has not been installed or does not react.
	“Lamp supply temperature limit exceeded”	The upper temperature limit for power supply of lamp was exceeded.
	“Lamp unit temperature limit exceeded”	The upper temperature limit for lamp unit was exceeded.
	“Lamp unit temperature sensor failed”	Temperature sensor of lamp unit was not found or does not react.
	“Leak sensor failed”	Switch the device off and then on. If the leak sensor is still not present, contact the Technical Support of the manufacturer. Leak sensor was not found or does not react.
	“Leak was detected”	Switch off the device. Remove the leak and start the device afterwards.
N	“No D2 lamp detected”	Check if the deuterium lamp was installed correctly.
	“Not available for this communication mode”	3D data acquisition or simple scans via RS-232 are not possible.
R	“Recommended D2 lamp life exceeded”	The recommended operating time of the deuterium lamp of 2000 hours was exceeded. Replace the lamp.
	“Recommended HAL lamp life exceeded”	The recommended operating time of the halogen lamp of 1000 hours was exceeded. Replace the lamp.
S	“Shutter position failed”	Malfunction of cover motor
	“Spectrum buffer overflow”	The internal 3D data buffer was used up because of a LAN connection error.
	“Spectrum output busy or not ready”	3D data acquisition can not be started. Wait until data transfer is finished and continue afterwards.
T	“Temperature control failed”	The upper temperature limit of the lamp unit was exceeded.
	”Time already exists”	Correct the time entry.

	System Message	Problem and Solution
W	"Wake up time already passed"	Wakeup time is in the past. Specify new time.
	"WL/BW out of spectral range"	Selected path length and bandwidth exceed the spectral range. Expand the selected spectral range or the selected path length/bandwidth.
	"WL validation failed"	Wavelength accuracy test failed. Restart the validation. Holmium oxide and/or H_α, H_β lines do not meet the specifications. In case the system message repeats itself, inform the Technical Support of KNAUER .

Maintenance and Care

In this chapter, you find the information relevant for maintenance, care and storage. Additionally, you find instructions for maintenance tasks that may be performed by the customer. In case there are any maintenance tasks on that you do not find instructions here, contact your supplier or the Technical Support.

Organic eluents are toxic above a certain concentration. Ensure that work areas are always well-ventilated! When performing maintenance tasks on the device, always wear safety glasses with side protection, protective gloves, and an overall.

All wetted components of a device, e. g. flow cells of detectors, have to be flushed with isopropanol first and water second before being maintained, disassembled or disposed.

Opening the Module

The device may only be opened by the Technical Support of KNAUER or any company authorized by KNAUER.

WARNING!
Irritation of retina through UV light! Concentrated UV light can leak out from the flow cell or the fiber optic connectors.
- Switch off the device or the lamps.

CAUTION!
Performing maintenance tasks on a switched on device can cause damage to the device.
Switch off the device and pull the power plug.

DANGER!
High voltages pose a life-threatening risk.
Before opening the device, turn off the device and pull the power plug.

Users may perform the following maintenance tasks themselves:

- Regularly check the operating hours of the lamp.
- Inspect the installation of the flow-cell.
- Replace the flow cell.
- Replace the lamp.

Proper maintenance of your HPLC device will ensure successful analyses and reproducible results.

You find the order numbers for the desired spare parts at the end of this manual (see “Accessories and Spare Parts” on page 59).

Contacting the Technical Support

If you have any technical questions regarding KNAUER hardware or software, please use one of the contact options below:

Technical Support hotline:

Hotline Europe

Languages:	Available by telephone
in German or English:	8 am to 5 pm (CET)
Phone:	+49 30 809727-111
Telefax:	+49 30 8015010

E-mail: support@knauer.net

Maintenance Contract

The following maintenance work on the device may only be performed by KNAUER or a company authorized by KNAUER and is covered by a separate maintenance contract:

- Opening the device or removing housing parts.

Maintenance Intervals

Operating Hours

Using the Control Unit, Mobile Control or software you can read out the operating hours of the detector. You find a detailed description on how to read out GLP data in the respective user manuals.

Operating Hours	Measures
1000	▪ Replace halogen lamp (DAD 6.1L).
2000	▪ Replace deuterium lamp.

Cleaning and Caring for the Device

CAUTION!
Intruding liquids can cause damage to the device.
- Place solvent bottles next to the device or in a solvent tray.
- Moisten the cleaning cloth only slightly.

All smooth surfaces of the device can be cleaned with a mild, commercially available cleaning solution, or with isopropanol.

Checking the Fittings

Check if all fittings are tight. In case you find fittings that are not tight, tighten them up.

Capillary Screw Fittings	Torque
Stainless-steel fittings	5 Nm
PEEK fittings	0.5 Nm

Decommissioning

The detector is designed for the use of different solvents. In case the detector has not been used for several weeks, solvent residues may cause damage. We, therefore, recommend to:

- Flush the flow cell and the capillaries.
- Completely remove used solvents.
- Fill the flow cell and the capillaries with isopropanol.

Before storage, close the open connectors of the flow cell with hole plugs.

Prerequisites The detector has been flushed.

Auxiliary Material hole plugs and/or cap fittings

Procedure

Process
1. Unscrew the eluent supply lines and close the open connectors with hole plugs.
2. Disconnect the detector from the system and close the open connector of the flow cell with a hole plug.

Next Steps Select a storage location according to the requirements, which are listed in the according chapter of this manual.

Storage

Pay attention that all hoses and capillaries have been emptied or filled with flushing solution (e. g. isopropanol) before storage. To prevent algae formation, do not use pure water. Close all inputs and outputs with cap fittings.

Pay attention to the ambient conditions for storage (see 'Technical Data' on page 52).

Disconnecting the Power Supply

Prerequisites The device has been switched off.

Procedure

Process
1. Pull the power plug out of the socket and afterwards out of the device.
2. Pack the power cable together with the device.

Next Steps Disconnect further electrical connections. Remove the flow cell and pack the device for transport or storage.

Cleaning the Flow Cell

Increased noise of the baseline and reduced sensitivity can be a result of a dirty flow cell. Often it is sufficient to rinse the flow cell to restore optimal sensitivity.

Rinsing the Flow Cell

The following solvents are recommended for rinsing:

- dilute HCl (1 mol/L)
- 1 mol/L NaOH aq.
- Ethanol
- Acetone

Tools Syringe

CAUTION!
Contamination of the flow cell caused by oil drops!
- Do not use compressed air for drying.

Procedure

1. Fill the syringe with eluent.
2. Inject it into the inlet of the flow cell and allow it to act for 5 minutes.
3. Repeatedly flush with syringe and water.
4. Remove the flow cell from the detector and use a nitrogen stream to dry it.

Next Steps Check, if the baseline noise has disappeared.

Replacing the Flow Cell

UV light will cause the flow cells to become blind with time (solarization), making them no longer suitable for use. The manufacturer recommends replacing the flow cell after about 6000 operating hours.

Prerequisites

- The capillaries are disconnected.
- The device is switched off.

WARNING!
Irritation of retina through UV light! Concentrated UV light can leak out from the flow cell or the fiber optic connectors.
- Switch off the device or the lamps.

Procedure

Steps	Figure
1. Press the release lever ① down. 2. The flow cell is being released and can be pulled out. 3. Push in the new flow cell until it locks into place.	 **Fig. 31 releasing the flow cell**

Next Steps Connect the capillaries.

Replacing the Lamps

Replace the lamp if it malfunctions or its intensity is low.

DAD 6.1L, DAD 2.1L, MWD 2.1L
- The recommended operating time of the deuterium lamp is 2000 hours.

DAD 6.1L
- The recommended operating time of the halogen lamp is 1000 hours.

Legend

① deuterium lamp connector

② halogen lamp connector (DAD 6.1L)

③ halogen lamp (DAD 6.1L).

④ deuterium lamp

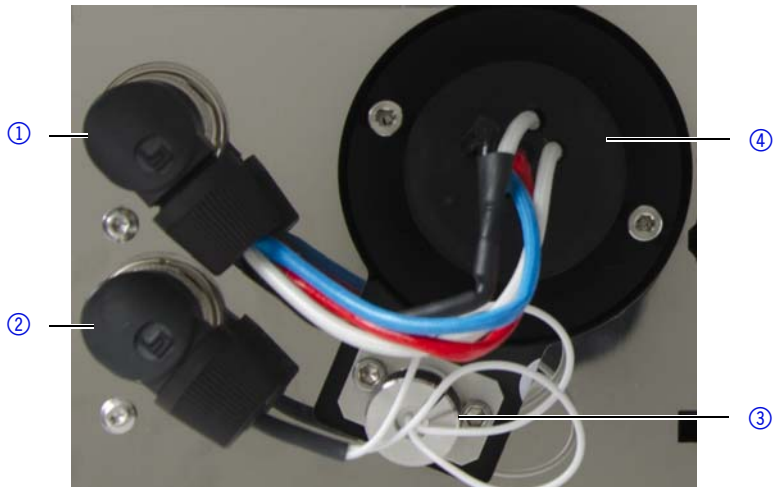


Fig. 32 overview deuterium lamp and halogen lamp

Removing the Deuterium or Halogen Lamp

Prerequisites
- The device is switched off.
- The lamp has cooled down.

Tools Allen screwdriver, 2.5 mm

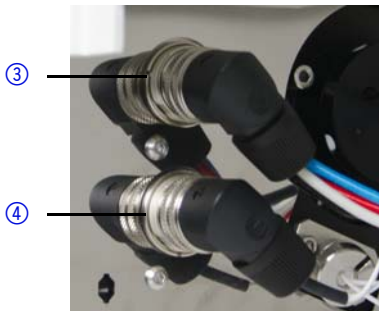
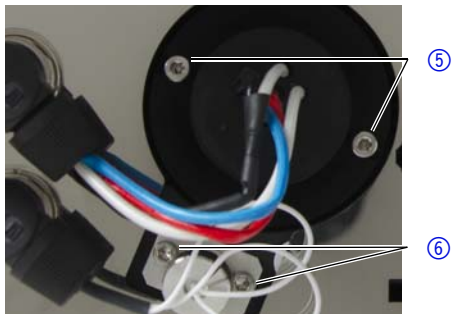
Note If the device is still in operation, the integrated security switch turns off the lamp automatically on opening the lamp cover. An error message is displayed. Additionally, the red LED lights up and the center LED doe not light.

DANGER!
High voltages pose a life threatening risk.
- Do not change lamps if the lamp area is not voltage-free.
- Check the status of the lamps in the software and on the LEDs.

WARNING!
Burn hazard from hot lamp!
- Switch off the lamp meanwhile the device remains switched on for further 15 minutes, otherwise the lamp can not cool down.
- Afterwards, switch off the device and pull the power plug.

Procedure

Deuterium Lamp

Process	Figure
1. Loosen the screws ① and ② of the lamp cover. 2. Remove the lamp cover.	 **Fig. 33 lamp cover**
3. Loosen the lock ring 3 or 4 of the lamp plug and pull out the plug.	 **Fig. 34 lock ring of lamp plug**
4. Using the screwdriver, loosen the two screws ⑤ or ⑥. 5. Remove the lamp.	 **Fig. 35 screws on the lamp socket**

Next Steps Insert a new lamp.

Installing the Deuterium or Halogen Lamp

Removing the lamp cover switches off the device.

Prerequisites

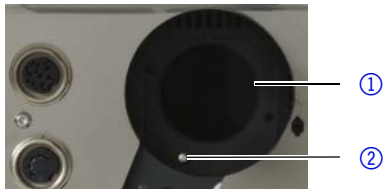
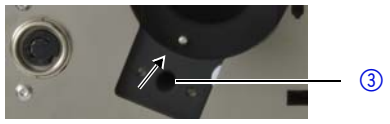
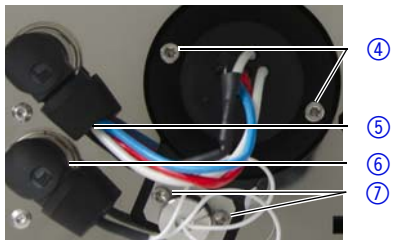
- The device is switched off.
- The lamp cover has been removed.
- The old lamp has been removed.

Tools Allen screwdriver, 2.5 mm

Note You can clean the lamp thoroughly with a lint free cloth and isopropanol.

CAUTION!
Damage to the lamp and inaccurate measuring results due to residue possible.
- Do not touch the glass body with your hands.
- Wear gloves.
- Use a clean, soft cloth.

Procedure

Process	Figure
1. Hold the lamp at the lamp socket and guide the glass body into the lamp pod ①. 2. The bolt ② of the deuterium lamp sits in a notch in the lamp socket. 3. Insert the halogen lamp ③ into the lamp pod at a slight angle.	 **Fig. 36 lamp pod deuterium lamp**  **Fig. 37 lamp pod halogen lamp**
4. Using the screwdriver, tighte the two screws ④ or ⑦ on the lamp socket. 5. Connect the plug ⑤ or ⑥ and tighten the lock ring.	 **Fig. 38 installing the deuterium lamp**
6. Attach the lamp cover and fix it with the screws ⑧ and ⑨.	**Fig. 39 lamp cover**

Next Steps Bring the device into operation.

Removing the Leak

Prerequisites If the leak tray is filled with liquid, the leak has to be removed.

Auxiliary Material Cloth for drying the leak sensor

Procedure

Process
1. Remove the leak. 2. Dry the leak tray. 3. Acknowledge the error message via Mobile Control, Control Unit, the software or the standby switch (without software control).

Next Steps Bring the device into operation.

Technical Data

DAD 6.1L

Detection

detector type	diode array detector
number of diodes	1024
resolution of diodes	0.8 nm/diode
detection channels	8 (digital) 4 (analog)
light source	high intensity deuterium (D_2) lamp and halogen lamp with integrated GLP chip
wavelength range	190–1000 nm
spectral bandwidth	< 3.5 nm at H_α line (FWHM) *Note: digital bandwidth 1–32 nm*
wavelength accuracy	± 1 nm
wavelength verification	internal holmium filter and deuterium lines
wavelength precision	≤ 0.5 nm
noise	± 3.5 µAU at 254 nm
drift	300 µAU/h at 254 nm
linearity	> 2.0 AU at 274 nm
time constants	0.0 / 0.1 / 0.2 / 0.5 / 1.0 / 2.0 / 5.0 / 10.0 s
integration time	automatic (5–1000 ms)

Communication	maximum data rate	100 Hz (LAN) 12.5 Hz (analog)
	inputs	Error (IN), Start (IN), Autozero, 0–10 V Analog IN
	outputs	Events 1–2, Error (OUT), + 5 V, Valve + 24 V, Valve (OUT)
	analog outputs	4×0–5 V, 16 bit
	control	digital: LAN-DHCP, remote connector manual: Mobile Control or Control Unit (optional)
	programming	wake-up
	IP protection class	IP 20
Technical Parameters	GLP function	Detailed report about lamp recognition, operating hours, lamp operating hours, number of lamp ignitions.
	display	Mobile Control or Control Unit (optional)
Ambient Conditions	temperature range	4 – 40 °C, 39.2 – 104 °F
	air humidity	below 90 %, non-condensing
	height above sea level	maximum 2000 meters
General	power supply	100–240 V, 50–60 Hz, 75 W
	dimensions	361 mm x 158 mm x 523 mm (width× height × depth)
	weight	13.8 kg
	leak sensor	yes

DAD 2.1L

Detection	detector type	diode array detector
	number of diodes	256
	resolution of diodes	2 nm/diode
	detection channels	8 (digital) 4 (analog)
	light source	deuterium (D_2) lamp with integrated GLP chip
	wavelength range	190–700 nm
	spectral bandwidth	< 8 nm at H_α line (FWHM) *Note: digital bandwidth 1–32 nm*

	wavelength accuracy	± 1 nm
	wavelength precision	± 0.1 nm
	wavelength verification	internal holmium filter and deuterium lines
	noise	± 5 µAU at 254 nm
	drift	400 µAU/h at 254 nm
	linearity	> 1.6 AU at 274 nm
	time constants	0.0 / 0.1 / 0.2 / 0.5 / 1.0 / 2.0 / 5.0 / 10.0 s
	integration time	automatic (5–1000 ms)
Communication	maximum data rate	100 Hz (LAN) 12.5 Hz (analog)
	inputs	Error(IN), Start (IN), Autozero, 0–10 V Analog IN
	outputs	Events 1–2, Error (OUT), + 5 V, Valve + 24 V, Valve (OUT)
	analog outputs	4×0–5 V, 16 bit
	control	digital: LAN-DHCP, remote connector manual: Mobile Control or Control Unit (optional)
	programming	wake-up
	IP protection class	IP 20
Technical parameters	GLP function	Detailed report about lamp recognition, operating hours, lamp operating hours, number of lamp ignitions.
	display	Mobile Control or Control Unit (optional)
Ambient Conditions	temperature range	4 – 40 °C, 39.2 – 104 °F
	air humidity	below 90 %, non-condensing
	height above sea level	maximum 2000 meters
General	power supply	100 – 240 V, 50 – 60 Hz, 75 W
	dimensions	361 mm x 158 mm x 523 mm (width× height × depth)
	weight	12.2 kg
	leak sensor	yes

MWD 2.1L

Detection	detector type	multiwavelength detector
	detection channels	8 (digital) 4 (analog)
	light source	deuterium (D_2) lamp with integrated GLP chip
	wavelength range	190-700 nm
	spectral bandwidth	< 8 nm at H_α line (FWHM) *Note: digital bandwidth 1–32 nm*
	wavelength accuracy	± 1 nm
	wavelength precision	0.1 nm
	wavelength verification	internal holmium filter and deuterium lines
	noise	± 5 µAU at 254 nm
	drift	400 µAU/h at 254 nm
	linearity	> 1.6 AU at 274 nm
	time constants	0.0 / 0.1 / 0.2 / 0.5 / 1.0 / 2.0 / 5.0 / 10.0 s
	integration time	automatic (5–1000 ms)
Communication	maximum data rate	100 Hz (LAN) 12.5 Hz (analog)
	inputs	Error(IN), Start (IN), Autozero, 0–10 V Analog IN
	outputs	Events 1–2, Error (OUT), + 5 V, Valve + 24 V, Valve (OUT)
	analog outputs	4x0–5 V, 16 bit
	control	digital: LAN-DHCP, remote connector manual: Mobile Control or Control Unit (optional)
	programming	wake-up
	IP protection class	IP 20
Technical parameters	GLP function	Detailed report about lamp recognition, operating hours, lamp operating hours, number of lamp ignitions.
	display	Mobile Control or Control Unit (optional)
Ambient Conditions	temperature range	4 – 40 °C, 39.2 – 104 °F

	air humidity	below 90 %, non-condensing
	height above sea level	maximum 2000 meters
General	power supply	100 – 240 V, 50 – 60 Hz, 75 W
	dimensions	361 mm x 158 mm x 523 mm (width× height × depth)
	weight	12.2 kg
	leak sensor	yes

Conditions for Specification

Technical data has been determined in accordance with the ASTM standard E1657-98: "Standard Practice for Variable-Wavelength Photometric Detectors Used in Liquid Chromatography".

Reference conditions: test cell at wavelength 254 nm/8 nm with reference wavelength 360 nm/30 nm, time constant 2 s, data rate 1 Hz.

Linearity: Linearity is measured with caffeine at 274 nm/8 nm and time constant 2 s with a flow cell path length 10 mm.

Performance tests should be done with a completely warmed up optical unit (> 2 hours). ASTM measurements require that the detector should be turned on at least 24 h before start of testing. ASTM drift tests require a temperature change below 2 °C/ hour over a one hour period.

Disposal

Hand in old devices or disassembled old components at a certified waste facility, where they will be disposed of properly.

AVV Marking in Germany

According to the German "Abfallverzeichnisverordnung" (AVV) (January, 2001), old devices manufactured by KNAUER are marked as waste electrical and electronic equipment: 160214.

WEEE Registration

KNAUER as a company is registered by the WEEE number DE 34642789 in the German "Elektroaltgeräteregister" (EAR). The number belongs to category 8 and 9, which, among others, comprise laboratory equipment.

All distributors and importers are responsible for the disposal of old devices, as defined by the WEEE directive. End-users can send their old devices manufactured by KNAUER back to the distributor, the importer, or the company free of charge, but would be charged for the disposal.

Solvents and Other Operating Materials

All solvents and other operating materials must be collected separately and disposed of properly.

All wetted components of a device, e. g. flow cells of detectors or pump heads and pressure sensors for pumps, have to be flushed first with isopropanol and then with water before being maintained, disassembled or disposed.

Legal Information

Warranty Conditions

The factory warranty for the device is valid for 12 months after the date of dispatch. All warranty claims shall expire in the event that any unauthorized changes are made to the device.

During the warranty period, any components with material or design-related defects will be replaced or repaired by the manufacturer free of charge.

This warranty excludes the following:

- accidental or willful damage
- damage or errors caused by third parties that are not contractually related to the manufacturer at the time the damage occurs
- wear parts, fuses, glass parts, columns, light sources, cuvettes and other optical components
- damage caused by negligence or improper operation of the device and damage caused by clogged capillary
- packaging and transport damage

In the event of device malfunctions, directly contact the manufacturer.

KNAUER Wissenschaftliche Geräte GmbH
Hegauer Weg 38
14163 Berlin, Germany
Phone: +49 30 809727-111
Telefax: +49 30 8015010
e-mail: info@knauer.net
Internet: www.knauer.net

Transport Damage

The packaging of our devices provides the best possible protection against transport damage. Check the devices for signs of transport damage. In case you notice any damage, contact the Technical Support and the forwarder company within three workdays.

HPLC Glossary

In the following chapter you find abbreviations and terminology that is used in HPLC.

Term	Definition
absorption	The process of retention in which the solute partitions into a liquid-like coating.

Term	Definition
adsorption	A process of retention in which the interactions between the solute an dthe surface of an adsorbent dominate.
analytical	Qualitative analysis of samples in HPLC
backflushing	Useful in chromatography to remove compounds that are held strongly at the head of a column.
calibration	A process for correcting measuring values by the value that a measuring device deviates from the standard.
capillary	Tubing to connect various parts of the chromatograph in order to direct flow to the proper place.
carrier	Refers to the support that is used to attach the active ligand, usually by a covalent bond.
chromatogram	A plot of detector signal output versus time or elution volume during the chromatographic process.
column	The tube and stationary phase through which mobile phase flows resulting in a chromatographic separation.
correction factor	factor that arithmetically corrects device-related deviations from measuring values
dead volume	Dead volume is extra volume experienced by solutes as they pass through a chromatographic system, in particular any unswept volume exposed to the mobile phase flow.
degassing	The process of removing dissolved gas from the mobile phase prior or during use.
detector	device measuring the composition or the quantity of a substance
gradient	A process to change solvent strength as a function of time (normally solvent strength increases) thereby eluting progressively more highly retained analytes.
isocratic	mode of sample separation where the composition of a solvent remains constant
LightGuide	KNAUER LightGuide flow cell cartridges combine a maximum light transmission (using total reflection) with a minimum cell volume to offer an ideal signal-to-noise ratio.
Luer-Lock	a standardized connector between syringes and cannulas

Term	Definition
mobile phase	The fluid that moves solutes through the column.
packing	The adsorbent, gel, or solid support used in the chromatography column.
preparative	Isolating the maximum amount of a substance in a short amount of time in a required purity
response time	Time for a detector to respond to ~90 % of the incoming solute amount. The response time is generally taken as 2–4 times the time constant.
retention time	The time required from an injection of a substance until the maximum concentration of a substance becomes visible.
sample	A mixture of different components which are to be separated via chromatography. The components are moved by the mobile phase and dissolved from the column.
sample loop	A loop which is separate from a chromatographic system and which the sample is injected to. After a switch is actuated, the solvent flow passes the loop and the sample is flushed onto the column.
solute	The dissolved component of a mixture that is to be separated in the chromatographic column.
solvent	The liquid used to dissolve a sample for the injection into a chromatography column or CE capillary.
stationary phase	The immobile phase involved in the chromatographic process. It is the liquid or the liquid film on the surface of the packing material.

Accessories and Spare Parts

Note For repeat orders of spare parts use the enclosed packing list. Contact the Technical Support in case there are any questions on spare parts or accessories.

Further Information Further information on spare parts and accessories can be found online: www.knauer.net

Device

	Name	Order Number
DAD 6.1L	diode array detector DAD 6.1L with test cell	ADC11
DAD 2.1L	diode array detector DAD 2.1L with test cell	ADC01
MWD 2.1L	multi wavelength detector MWD 2.1L with test cell	ADB01
	upgrade MWD 2.1L to DAD	ADB01UMBAU

Accessories and Spare Parts

	Name	Order Number
User Manual	user manual EN/DE	V6700
Operation Qualification	DAD 6.1L DAD 2.1L MWD 2.1L	VOQDAD61L VOQDAD21L VOQMWD21L
Installation Qualification	DAD 6.1L DAD 2.1L MWD 2.1L	VIQDAD61L VIQDAD21L VIQMWD21L
Lamps	high intensity deuterium lamp (for DAD 6.1L)	AZL01
	halogen lamp (for DAD 6.1L)	AZL02
	standard deuterium lamp (for DAD 2.1L and MWD 2.1L)	A5193
Drainage System	corrugated hose, 16 cm, PE grey	A9846-1
	funnel	P6431
	exhaust	P6432
	capillary guide top	P6424
	capillary guide bottom	P6425
Waste Tubing Kit	kit LightGuide flow cells 1/16”	A9842
	kit UV flow cells 1/16”	A9843
	kit UV flow cells 1/8”	A9844
Mounting Bracket	mounting bracket for flow cells	A9853-5
Control Unit	Control Unit CU 2.1	AZD00
Accessories Kit	AZURA accessories kit	FZA02
	DAD 6.1L, DAD 2.1L, MWD 2.1L accessories kit	FDC
Tools	AZURA tool kit	A1033

Flow Cells

	Technical Data		Order Number
KNAUER LightGuide Flow Cell Cartridge	path length connection volume wetted parts max. flow rate max. pressure	10 mm 1/16“ 2 µl (0.8 µl dispersion vol.) PEEK, quartz, Teflon 5 ml/min 100 bar	AMC19
KNAUER LightGuide High Sensitivity Flow Cell Cartridge	path length connection volume wetted parts max. flow rate max. pressure	50 mm 1/16“ 6 µl (2 µl dispersion vol.) PEEK, quartz, Teflon 5 ml/min 100 bar	AMD59

Flow Cells with Fiber Optics

Note Flow cells with fiber optics are connected to the devices via a fiber optics adapter. The fiber optic cables must be ordered separately.

Technical Data		Order Number
path length connection volume wetted parts max. flow rate max. pressure	10 mm 1/16“ 10 µl SS, quartz, PEEK 20 ml/min 300 bar	A4074
path length connection volume wetted parts max. flow rate max. pressure	3 mm 1/16“ 2 µl SS, quartz, PTFE 50 ml/min 300 bar	A4044
path length connection volume wetted parts max. flow rate max. pressure	3 mm 1/16“ 2 µl PEEK, quartz, PTFE 50 ml/min 30 bar	A4047
path length connection volume wetted parts max. flow rate max. pressure	0.5 mm 1/16“ 3 µl SS, quartz, PTFE 250 ml/min 200 bar	A4089

	Technical Data		Order Number
	path length connection volume wetted parts max. flow rate max. pressure	0.5 mm 1/16“ 3 µl PEEK, quartz, PTFE 250 ml/min 100 bar	A4096
	path length connection volume wetted parts max. flow rate max. pressure	0.5 /1.25 /2 mm 1/8“ 1.7/4.3/6.8 µl SS, quartz, PTFE 1000 ml/min 200 bar	A4078
	path length connection volume wetted parts max. flow rate max. pressure	0.5 /1.25 /2 mm 1/8“ 1.7/4.3/6.8 µl PEEK, quartz, PTFE 1000 ml/min 100 bar	A4079
	path length connection volume wetted parts max. flow rate max. pressure	0.5 /1.25 /2 mm 1/4“ 1.7/4.3/6 µl SS, quartz, PTFE 10000 ml/min 200 bar	A4081
Fiber Optics Adapter	required for the connection of fiber optics		AMKX8
Fiber Optics Adapter Kit	including fiber optics adapter, fiber optic cables and mounting bracket Ideal for semi-preparative and preparative remote flow cells		AMKX8KIT

Fiber Optic Cables

Name	Order Number
2 x fiber optics, 750 mm	A0740
2 x fiber optics, custom made	A0743
1 x fiber optics, 400 mm	A0911
1 x fiber optics, 750 mm	A0742

Index

A

absorption **35, 36, 57, 58**
accessories **10**
adapter **17**
additives **9**
ambient conditions **15, 47, 52, 53, 54, 55**
analog port **27**
analytical **58**
AVV marking **56**

B

backflushing **58**
bandwidth **36**
 default **36**
Beer-Lambert law **34**

C

capillary **18, 58**
 fitting **19**
 lock ring **19**
 pre-installed **29**
 torque **19**
care **46**
chromatogram **58**
ClarityChrom **30**
clean **46**
conditions for specification **56**
contact data **46**
control **20, 30**
 Control Unit **20**
 LAN **20**
Control Unit **20, 30, 46**
cutoff **35**

D

D2 lamp
 replace **49**
data rate **8, 37**
 default **37**
 optimize **37**
dead volume **35**
decommissioning **47**
decontamination **13**
default settings
 32
degasser **58**
detector **58**
 optimize **32**
 rear view **7**
 technical data **52**
device overview **6**
disposal **56**
drift **35**

E

eluents **9**

F

features **7**
fiber optics **17, 62**
 adapter **17**
 flow cell **17**
fittings **47**
flow cell **8**
 clean **48**
 connection **35**
 fiber optics **61**
 insert **17**
 material **35**
 path length **34**
 pressure stability **35**
 rinse **48**
 select **33**
 volume **33**
flow cell cartridges **8**
front view **6**
functionality tests **39**

G

general **39**
glossary **57**
GLP data **8**
gradient **58**
GROUND, see spring strip **26**

H

halogen lamp
 replace **49**
HPLC glossary **57**

I

installation **14**
 site **15**
integrator **27**
intended use **6**
IQ **39**
isocratic **58**

L

lamp
 replace **49**
lamps **8**
LAN **20, 40**
 port **23**
 problems **40**
 router **23**
 settings **21**
 setup **22**
leak **12**
 management **8, 19**
 remove **52**
 sensor **52**
LED **31**
Legal Information **57**
location **32**
Luer-lock cannula **58**

M

maintenance **45**
 contract **46**
 intervals **46**
mandatory signs **14**
mirror **8**
Mobile Control **30, 46**
mobile phase **59**
modifiers **9**

O

OpenLAB **30**
operating environment **15**
operating hours **46**
operating ranges **6**
operation **29**
 Control Unit **30**
 software **30**
optimize **32**
 wavelength **35**
optional accessories **9**
OQ **39**
order numbers **60**

P

packing list **17**
path length **34**
peak broadening **33**
PEEK **9**
 fittings **19**
pin header
 Autozero **26**
 connect **26**
 connectors **24**
 Start IN port **25**
port (LAN) **23**
power
 connect **27**
 disconnect **15**
 plug **15**
 strip **12**
 supply **12**
power supply
 cable **12**
pressure maximum **35**
problems **41**
 further measures **41**
professional group **11**

R

rear view **6**
reference wavelength **35, 36**
 default **36**
refractive index **35**
remote connector
 pin header **24**
remote operation **35**
repeat orders **59**
 accessories and spare parts **60**
 device **60**
 fiber optics **62**
 flow cell **61**
re-set **32**
response time **37, 59**
router (LAN) **23**

S

safety **11**
safety equipment **11**
salts **9**
sample **59**
selectivity **36**
self-validation **30**
sensitivity **33, 35, 36**
service **46**
setup **16**
side view **7**
signal level **38**
signal wavelength **35, 36**
software **46**
solvent
 flammability **12**
 line **12**

self-ignition point **12**
toxicity **12**
tray **12**
space requirements **15, 16**
spare parts **10, 59**
standby **31**
Start IN, see pin header **25**
start-up **29**
storage **45, 47**
subtraction **38**
system messages **41**

T

technical data
detector **52**
Technical Support **46**
test
Installation Qualification **39**
Operation Qualification **39**
time constant **37**
transport damage **57**
troubleshooting **40**
LAN **40**

U

unpacking **16**
USB **7**

W

warm up time **33**
warning signs **13**
warranty **57**
wavelength
cutoff **35**
select **35**

Declaration of Conformity

Producer	KNAUER Wissenschaftliche Geräte GmbH Hegauer Weg 38 14163 Berlin, Germany		
Model/Type Reference	Detector	1. DAD 6.1L	Product No.: EDC11
		2. DAD 2.1L	Product No.: EDC01
		3. MWD 2.1L	Product No.: EDB01
	The product complies with the following standards:		

Machinery	Machinery Directive 2006/42/EC
EMC	EMC Directive 2004/108/EC IEC 61000-3-2:2012 IEC 61326-1:2011
Disposal	RoHS directive 2011/65/EU WEEE directive 2012/19/EU
Safety	Low Voltage Directive 2006/95/EC IEC 61010-1:2010 IEC 61010-2-081:2001 + A1 Canada: CSA C22.2 No. 61010-1 (3rd Edition, 2012) USA: UL 61010-1 (3rd Edition, 2012)

CE

The product was tested with a typical configuration. The mark of conformity has been applied to the rear panel.

Date Berlin, 2014-10-01

A. Knauer

Alexanda Knauer (CEO and owner)

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